



Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 6134-2 (1973): Methods of measurement of electrical characteristics of microwave tubes, Part 2: Oscillator tubes [LITD 4: Electron Tubes and Display Devices]

“ज्ञान से एक नये भारत का निर्माण”

Satyanareshwar Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśākām

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE

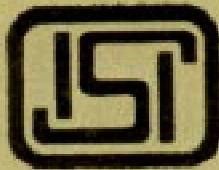


PROTECTED BY COPYRIGHT

IS : 6134 (Part II) - 1973

Indian Standard
METHODS OF MEASUREMENTS ON
MICROWAVE TUBES
PART II OSCILLATOR TUBES

UDC 621.373.4 : 621.317.3-08



© Copyright 1973

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

Price Rs 2.50

August 1973

Revised Price Rs 5.00

Gr 2

Indian Standard
METHODS OF MEASUREMENTS ON
MICROWAVE TUBES

PART II OSCILLATOR TUBES

Electron Tubes Sectional Committee, ETDC 39

Chairman

PROF S. SAMPATH

Indian Institute of Technology, Madras

Members

DR S. S. S. AGARWALA	<i>Representing</i> Central Electronics Engineering Research Institute (CSIR), Pilani
SHRI H. K. L. ARORA	All India Radio & Electronics Association, Bombay
SHRI R. C. KESWANI (Alternate) (Bombay)	
SHRI ARUP CHAUDHURI (Alternate) (Calcutta)	
SHRI L. S. V. EASWAR (Alternate) (Madras)	
SHRI BALRAJ BHANOT DIRECTOR, ELECTRICAL ENGINEERING	Directorate General of Technical Development Naval Headquarters (Ministry of Defence)
RING	
DIRECTOR, ELECTRONICS & RADAR DEVELOPMENT ESTABLISHMENT	Directorate General of Research Development (DGRD) (Ministry of Defence)
SHRI B. P. GHOSH	National Test House, Calcutta
SHRI R. K. JAIN	Radio Electronic & Television Manufacturers' Association (RETMA), Calcutta
SHRI S. B. PAI (Alternate)	
SHRI S. C. MAJUMDAR	Directorate General of Civil Aviation (Ministry of Tourism & Civil Aviation)
SHRI A. V. RAJU	Directorate of Technical Development & Production (Air) (Ministry of Defence)
SHRI P. M. SHANKAR RAO (Alternate)	
SHRI P. K. RAO	Directorate General of Inspection (Ministry of Defence)
KUMARI V. SURYAKANTHI (Alternate)	
SHRI S. N. SEN	All India Radio, New Delhi
SHRI G. H. VAZE	Bhabha Atomic Research Centre, Bombay
DR R. P. WADHWA	Bharat Electronics Ltd, Bangalore
SHRI N. SRINIVASAN, Deputy Director (Elec tech) (Secretary)	Director General, ISI (Ex-officio Member)

(Continued on page 2)

© Copyright 1973

INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act (XIV of 1957)* and
reproduction in whole or in part by any means except with written permission of the
publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page 1*)

Panel for Microwave Tubes, ETDC 39 : P5

Convener

DR S. S. S. AGARWALA

Representing

Central Electronics Engineering Research Institute
(CSIR), Pilani

Members

SHRI B. L. GUPTA

Bhabha Atomic Research Centre, Bombay

SHRI A. K. MAJUMDAR

Bharat Electronics Ltd, Bangalore

DR D. S. VENKATESHWARULU (*Alternate*)

SHRI K. V. NARAYANA MURTHY

Civil Aviation Department, New Delhi

SHRI P. S. SARAN

Telecommunication Research Centre (P & T Board),
New Delhi

SHRI K. SRIDHAR

Indian Telephone Industries Ltd, Bangalore

SHRI M. D. SANTHANAM (*Alternate*)

LT-COL B. D. VERMA

Directorate General of Inspection (Ministry of
Defence)

SHRI N. CHANDRAPAL (*Alternate*)

Indian Standard
METHODS OF MEASUREMENTS ON
MICROWAVE TUBES
PART II OSCILLATOR TUBES

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 23 April 1973, after the draft finalized by the Electron Tubes Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard deals with the methods of measurements of characteristics of microwave oscillator tubes which are common to the family of oscillator tubes. The measurements described in this standard are either in addition to or alternate to those given in Part I of this series of standards on microwave tubes measurement. Specific types of oscillator tubes will be dealt with separately to which this standard and Part I of this series will form necessary adjuncts.

0.3 While preparing this standard, assistance has been derived from Pub 235-2 'Measurement of the electrical properties of microwave tubes, Part 2 General Measurements', issued by the International Electrotechnical Commission.

0.4 This standard is one of a series of Indian Standards on microwave tubes. A list of standards published so far on microwave tubes is given on fourth cover.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part II) deals with methods of measurements of characteristics of microwave oscillator tubes which are common to the family of oscillator tubes.

*Rules for rounding off numerical values (*revised*).

1.1.1 Specific types of oscillator tubes, such as klystron oscillator tubes, diskseel tubes are dealt with separately.

2. TERMINOLOGY

2.1 For the purpose of this standard, the terms and definitions given in IS : 1885 (Part IV/Sec 3)-1971* shall apply.

3. GENERAL CONDITIONS

3.0 The provisions of IS : 6134 (Part I/Sec 1)-1971† shall apply.

4. FREQUENCY

4.1 Frequency Pulling Figure

4.1.1 This is measured with the tube operative under stated conditions when coupled into a load causing a stated voltage standing wave ratio (VSWR).

4.1.2 The frequency pulling figure is the difference between the extremes of frequency of oscillation which occur when the phase of the reflection coefficient of the load is varied through 2π radians.

NOTE — It should be ensured that the range for the phase variation is fully covered.

4.1.3 Precautions — Care should be taken that the VSWR remains between stated limits during variation of the phase of the reflection coefficient of the load, and that the rate of change of phase is rapid enough to avoid thermal drift effects. It may be necessary to state the distance between the output plane of the tube and the reference plane of the load.

4.2 Frequency Pushing Figure — This is measured by varying the electrode current periodically under the stated operating conditions. The difference between the extremes of frequency of oscillation throughout the stated current variation is measured. The frequency pushing figure is computed as the ratio between this difference in frequency, and the magnitude of the current variation.

4.2.1 Pulse Operation — The amplitude of the electrode current pulse is periodically modulated, usually sinusoidally, at such a rate that thermal effects may be neglected, provision being made to measure the difference in the peak values of the current due to modulation. The frequency change may be measured by a spectrum analyser or by a microwave receiver. The result is expressed as the ratio between the change in frequency, and the maximum difference between current peaks during a modulation cycle.

*Electrotechnical vocabulary : Part IV Electron tubes, Section 3 Microwave tubes.

†Methods of measurement on microwave tubes : Part I General measurements, Section 1 General conditions and precautions for measurements.

4.2.2 CW Operation — The electrode current is modulated smoothly, at least over the required range, at such a rate that thermal effects may be neglected. A frequency discriminator of high enough resolution to resolve the expected frequency difference is required. The output of the frequency discriminator is applied to one axis of a cathode-ray oscilloscope and the electrode current signal is applied to the other axis. The axis representing current is calibrated in such a way that the instantaneous frequency at all values of current can be observed.

4.3 Temperature Coefficient of Frequency — When operated under stated conditions, the frequency of oscillation is measured at two stated temperatures observed at a prescribed point on the body of the tube. The temperature variations can be produced by external means. The result is expressed as the ratio of the difference in frequency to the difference in temperature.

5. SPURIOUS MODE OSCILLATION

5.1 The existence of oscillation in spurious modes in the output and the power of this oscillation, may be checked by a spectrum analyser or by a microwave receiver. If an attenuator is used, it is inserted before the first mixer. In comparing the output in desired and spurious modes, the sensitivity *versus* frequency characteristics of the entire system including waveguide components and the spectrum analyser or receiver should be carefully calibrated.

6. PULSE STABILITY

6.1 Missing Pulses

6.1.1 Missing rf pulses may be recorded during a known time interval by an electronic counter activated by a circuit that detects missing rf pulses. The rectified rf pulse input to the circuit may be sampled from the tube load through a frequency selective device of suitable passband. The reference input to the circuit should be representative of the input pulse applied to the tube. The missing pulse detector employed should be capable of recording random and occasional deficient pulses, as well as consecutive clusters of deficient pulses.

6.1.2 The modulator, the load and other operating conditions should be kept constant during the measurement so that missing pulses are caused only by the tube being measured.

6.2 Pulse Mismatch Stability

6.2.1 Mismatch stability is measured as described in **6.1** with the load having a VSWR of stated value. A maximum value of the missing pulse

IS : 6134 (Part II) - 1973

factor is found by varying the phase of the reflection coefficient of the load at least by 2π radians.

NOTE — It should be ensured that the range for the phase variation is fully covered.

6.2.2 It may be necessary to state the distance between the output plane of the tube and the reference plane of the load, because this influences the Q-factor (long line effect) of the circuit which in turn can affect the stability of an oscillator.

6.3 Starting Stability of Snap-on-Stability — Measurement of starting stability of a pulsed generator is performed as the first measurement following a stated period of inactivity. The stated pulse voltage is applied instantaneously and observations of the missing pulse factor are made as described in **6.1**.

**INDIAN STANDARDS
ON
MICROWAVE TUBES**

IS :

1885 (Part IV/Sec 3)-1971 Electrotechnical vocabulary: Part IV Electron tubes, Section 3 Microwave tubes

1885 (Part IV/Sec 5)-1972 Electrotechnical vocabulary: Part IV Electron tubes, Section 5 Pulse terms

1885 (Part IV/Sec 6)-1972 Electrotechnical vocabulary: Part IV Electron tubes, Section 6 Noise in microwave tubes

2032 (Part XIII)-1971 Graphical symbols used in electrotechnology: Part XIII Microwave tubes

6134 (Part I/Sec 1)-1971 Methods of measurement on microwave tubes: Part I General measurements, Section 1 General conditions and precautions for measurements

6134 (Part I/Sec 2)-1972 Methods of measurements on microwave tubes: Part I General measurements, Section 2 Common to all devices

6134 (Part II)-1973 Methods of measurements on microwave tubes: Part II Oscillator tubes

6134 (Part III)-1973 Methods of measurements on microwave tubes: Part III Amplifier tubes

Note — For a complete list of Indian Standards on Electron Tubes, reference may be made to ISI Handbook.

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110001

Telephone : 27 01 31 (20 lines)

Telegrams : Manaksanstha

Branch Offices:

	Telephone
'Sadhna', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001	2 03 91
F Block, Unity Bldg, Narasimharaja Square, BANGALORE 560002	2 76 49
534 Sardar Vallabhbhai Patel Road, BOMBAY 400007	35 69 44
5 Chowringhee Approach, CALCUTTA 700013	23-08 02
5-9-201/2-A (First Floor), Chirag Ali Lane, HYDERABAD 500001	3 44 35
117/418 B Sarvodaya Nagar, KANPUR 208005	82 72
54 General Patters Road, MADRAS 600002	8 72 78